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10/594,284	09/26/2006	Andre Witzmann	3839	6105

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Huntington, NY 11743

EXAMINER

HORNING, JOEL G

ART UNIT	PAPER NUMBER
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1712

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/594,284	Applicant(s) WITZMANN ET AL.	
	Examiner JOEL G. HORNING	Art Unit 1712	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 May 2010.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-8, 17-19, 21 and 22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-8, 17-19, 21 and 22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>09-26-06</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Information Disclosure Statement

1. Given applicant's response to the previous office action, the IDS of September 26th, 2008 has been corrected to be as applicant had intended, and returned.

Claim Objections

2. A series of singular dependent claims is permissible in which a dependent claim refers to a preceding claim which, in turn, refers to another preceding claim.

A claim which depends from a dependent claim should not be separated by any claim which does not also depend from said dependent claim. It should be kept in mind that a dependent claim may refer to any preceding independent claim. In general, applicant's sequence will not be changed. See MPEP § 608.01(n). In the current claim set, claims 2-8 depend upon **subsequent** claim 17, so they are improper. This can be fixed at the time claims are identified as allowed, so the sequence of claims is not normally changed until then.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. **Claims 2-8, 17-19 and 21-22** are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time

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the application was filed, had possession of the claimed invention. Independent **claim 17** requires that “treating a surface of the refractory material only with laser radiation.” Independent **claim 22** requires that the “refractory material has been treated only with laser radiation.” The examiner can find no support for this negative limitation in applicant’s specification, and furthermore, applicant teaches performing additional treatments, such as a spraying treatment before or during the laser treatment, and a tempering treatment, which applicant makes no indication is performed with only a laser (page 3, lines 20-27). **Claims 2-8, 18, 19 and 21** are rejected for being dependent upon rejected claims.

4. **Claims 2-8, 17-19 and 21-22** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Independent claims 17 and 22 require that there be treatment of the refractory “only with laser radiation in order to form a surface layer that is a closed vitreous layer on said surface...”

However, it is unclear what other steps or elements are being excluded by this “only with laser radiation” limitation. It could be read to mean that the only treatment that is ever performed on the substrate is a laser irradiation treatment. However, in claim 17, applicant further requires an additional tempering treatment be performed on the substrate, and furthermore, applicant has not disclosed making the refractory with only laser radiation, or avoiding other treatments (like exposure to a gas) at all times before the laser treatment, so this seems to not be what applicant

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has intended. It could also be interpreted in other ways, such as to mean that the only radiation that the substrate is treated with is from a laser or that the only step that occurs during the treatment step of forming the closed vitreous surface layer is a laser irradiation treatment. However, in claim 8, applicant requires that a spray treatment be performed on the substrate as well during the laser treatment, so this interpretation is also problematic.

Applicant is required to correct this indefinite language. However, from applicant's arguments, in this amendment, applicant is trying to overcome the Bradley reference by excluding Bradley's taught laser treatment that includes pre-heating or simultaneously heating the substrate with an oxyacetylene torch (remarks, page 8). Therefore, for the purposes of examination, since this appears to be what applicant is trying to mean by this limitation, this limitation will be interpreted to at least be inclusive of the process where the treatment of making the closed vitreous layer by heating the substrate surface is performed without heating the refractory by means other than the laser, that is, utilizing only laser radiation to heat the refractory.

Claims 2-8, 18, 19 and 21 are rejected for being dependent upon rejected claims which makes their limitations indefinite as well.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

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the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148

USPQ 459 (1966), that are applied for establishing a background for determining

obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
 2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
5. **Claim 22** is rejected under 35 U.S.C. 103(a) as being unpatentable over Recasens et al (US 3837870) in view of Bradley et al (Materials Science and Engineering A (2000) 204-212) in view of Triantafyllidis et al (Applied Surface Science 186(2002) 140-144).

Recasens et al is directed towards the formation of refractory bricks (zirconium containing bricks), specifically ones to be used in glass furnaces (abstract) because of its high resistance to corrosion by molten glass (when the bricks are placed in contact with a glass melt during processing of the glass melt in the furnace). Its composition comprises alumina, silica, chromium oxide and zirconia and produces a vitreous phase (col 1, lines 29-40), Recasens et al further teaches that the inclusion of zirconia into the refractory adds plasticity to the composition which reduces cracking in the resulting refractory bricks (col 3, lines 19-30).

Bradley et al is directed towards a process for treating the surface of refractory bricks used in furnaces by exposing their surface to laser radiation, which

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seals the surface (closed) porosity and can result in a crack-free, dense laser treated layer on the refractory. Closing the porosity reduces the ingress of molten glassy material (slag) that is in contact with the refractory bricks, slowing down the degradation of the refractory, resulting in a longer life expectancy of the refractory (abstract).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to treat the refractory composition of Recasens et al by the process of Bradley et al: closing the porosity in a surface layer of the refractory in order to improve its corrosion resistance to molten glass, which the refractory would be in contact with when used in the intended glass furnace of Recasens et al.

Regarding the limitation that the laser treatment layer of the refractory be vitreous, as mentioned above, Recasens et al teaches that their refractory composition includes a vitreous phase. Likewise, Bradley teaches using their laser treatment to produce a smooth glassy surface zone (Section 3.1, page 209), which can be considered vitreous (vitreous means glass-like). Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to use the process of Bradley to make a vitreous surface on the refractory of Recasens et al, since Bradley teaches making the layer vitreous with its process.

Additionally, in applicant's specification, page 2, lines 20-22, applicant teaches that laser treatment to minimize porosity causes siliceous components of the refractory to partially or completely vitrify. Bradley et al teaches performing a similar laser treatment process to similar materials (in particular glass forming silica

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containing refractory materials, commonly known as glass-ceramics) in order to produce the same effect of creating a surface region of reduced porosity to increase the durability of the refractory to contact with molten glassy material.

When a reference discloses the limitations of a claim except for a property, and the Examiner cannot determine if the reference inherently possesses that property (in this case, that at least some of the material in the layer is vitreous), the burden is shifted to Applicant(s). In re Fitzgerald, USPQ 594 and MPEP §2112

Since the refractory material is what is modified by the laser to produce the closed layer, the closed layer will contain materials from the refractory material.

Bradley et al further teaches preheating the refractory to be laser treated, in order to avoid any remaining microcracks (section 3.1, page 209, right column). Bradley does not teach preheating by only using laser radiation, instead using a flame to preheat (section 1, page 205, right column).

However, Triantafyllidis et al, like Bradley et al, is directed towards the laser treatment of refractory brick surfaces in order to improve the molten glass corrosion resistance. It specifically recognizes the Bradley et al preheating solution to cracks, and teaches that instead of using a flame to preheat the refractory like Bradley, an additional laser can instead be used in order to preheat and post heat the refractory (section 1, page 141).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to use laser radiation to preheat and post treat the Recasens et al refractory in the laser treatment process of Bradley et al, since it was a known

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alternative to using a flame (specifically contemplated as an alternative for the Bradley process), which would produce predictable results, which would be treating the refractory surface with laser radiation only during the treatment to make the closed vitreous layer.

Furthermore, since the intent of Recasens et al is to use the refractory in glass furnaces where they are in contact with a glass melt, it is obvious to process a glass melt with it in contact with the refractory of Recasens et al in view of Bradley et al in view of Triantafyllidis et al (**claim 22**).

6. **Claims 3-7, 17-19 and 21** are rejected under 35 U.S.C. 103(a) as being unpatentable over Recasens et al (US 3837870) in view of Bradley et al (Materials Science and Engineering A (2000) 204-212) in view of Triantafyllidis et al (Applied Surface Science 186(2002) 140-144) as applied to claim 22, further in view of Torok et al (US 3360353) further in view of Brennan et al (US 4415672).

Recasens et al in view of Bradley et al in view of Triantafyllidis et al does not teach using their treated refractory bricks suitable for use in a glass furnace specifically in a Danner blowpipe section of a glass furnace.

However, Torok teaches a furnace and method for producing glass wherein molten glass is in contact with a refractory coated mandrel during the process (abstract) and the mandrel can be a Danner blowpipe (col 1, lines 45-60). Torok teaches that the refractory material on the mandrel is formed of several uniform diameter segments, which can be considered bricks (col 3, lines 68-75). Torok further teaches that the refractory bricks of the Danner blowpipe erode as the molten

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glass is in contact, forming glass tubing. This causes defects in the produced glass tubing which necessitates replacing the refractory material in a time consuming process (col 1, line 62 through col 2, line 14).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to use the laser treated refractory bricks of Recasens et al in view of Bradley et al in view of Triantafyllidis et al in the Danner blowpipe and glassmaking process of Torok since they were refractory bricks suitable for such furnaces and it would reduce the erosion of the refractory bricks, allowing the production of longer sections of high quality pipe and increase the period between time consuming replacements of the refractory bricks of the blowpipe

Recasens et al in view of Bradley et al in view of Triantafyllidis et al is directed towards treatments for glass ceramics (alumina/silica)(e.g. Bradley et al page 205, section 2.1), but does not teach tempering the glass ceramic refractory after the laser treatment.

However, Brennan et al is also directed towards glass-ceramics and treatments for them. It teaches that glass-ceramics have good thermal properties and resistance to thermal shock, but that in order to increase their mechanical strength, a variety of tempering processes are performed upon them (col 1, lines 52-68).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to further temper the glass-ceramic refractory of Recasens et al in

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view of Bradley et al in view of Triantafyllidis et al after the laser treatment in order to increase the strength of the material (**claim 17**).

7. . Regarding **claims 3-5**, Bradley et al teaches that the power density, beam diameter and the beam scanning rate are result effective variables for controlling the smoothness and surface cracking in the resulting laser treated surface (section 2.2, page 206 and also Section 3.1, page 209, left column). By extension, the laser exposure time is the quotient of the beam diameter and the beam scanning rate, so it would also be a result effective variable for controlling the smoothness and cracking in the resulting surface.

Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to choose the instantly claimed ranges of “a power density of 2 to 4W/mm²” (**claim 3**), “an effective exposure time of 0.1 to 5 s” (**claim 4**), “a scan rate of 1-10 mm/s” and a laser beam “diameter of 2-5 mm” (**claim 5**) through process optimization, since it has been held that when the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. See *In re Boesch*, 205 USPQ 215 (CCPA 1980).

8. Regarding **claims 6 and 7**, Bradley et al teaches using a CO₂ laser (page 205, section 2.2), which, Triantafyllidis et al teaches has a wavelength of 10.6 microns (page 141, section 2).
9. Regarding **claim 18**, from figure 2c of Bradley et al, porosity is absent from the surface of the refractory until a depth of about 200microns, thus it is clear that the porosity has been closed in a thickness greater than 100 microns, but less than

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1mm (Section 3.1, page 209, right column, Figure 2c). Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to have a modified surface layer of about 200 microns, since that is a thickness that was demonstrated.

10. Regarding **claim 19**, since the refractory material is what is modified by the laser to produce the closed layer, the closed layer will contain materials from the refractory, including aluminum and zirconium.

11. Regarding **claim 21**, since the laser treatment is performed on the refractory bricks that are later placed into the Danner blowpipe which is then used in contact with a glass melt, the laser treatment to produce the closed vitreous layer is clearly performed before contact with the glass melt.

12. Claims 2 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Recasens et al (US 3837870) in view of Bradley et al (Materials Science and Engineering A (2000) 204-212) in view of Triantafyllidis et al (Applied Surface Science 186(2002) 140-144) in view of Torok et al (US 3360353) in view of Brennan et al (US 4415672) as applied to claim 17 above, further in view of Petitbon (US 4814575) as evidenced by Hancock et al (US 3929498).

Claim 8 further requires that the surface be sprayed with a powder or a solution before or during the laser treatment or that the ceramic body be infiltrated with a solution that includes zirconium or aluminum containing compounds.

Recasens et al in view of Bradley et al in view of Triantafyllidis et al in view of Torok et al in view of Brennan et al is directed towards methods of laser treating

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ceramic bodies so that the amount of porosity on the surface of the refractory is decreased, which improves the corrosion and spalling resistance of the refractory (e.g. Bradley et al page 204, abstract and introduction), but it does not teach adding a powder to the surface during laser exposure.

However, Petitbon is also directed towards methods of laser treating ceramic bodies so that their surface porosity is reduced. It teaches that by spraying a ceramic powder onto the substrate during the laser treatment, so that the powder and substrate surface melt, the molten powder particles will fill available surface porosity, thus reducing the presence of porosity or microcracks on the substrate surface, improving the microstructure and improving the properties (thermal expansion coefficient, residual stress, etc) of the surface (col 2, line 40 through col 3, line 13).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention performing the process of Recasens et al in view of Bradley et al in view of Triantafyllidis et al in view of Torok et al in view of Brennan et al to spray a powder at the substrate so that they melt together during laser treatment in order to avoid surface porosity or microcracks that may be present in the final surface, thus increasing the corrosion and spalling resistance as well as other properties of the substrate (**claim 8**).

13. Regarding **claim 2**, neither Bradley et al, Triantafyllidis et al nor Petitbon specify what the surface temperature of the substrate heated to as a result of the laser processing. However, as stated above Petitbon does teach powder is heated by the

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laser so that it is molten on the substrate surface. Petitbon further teaches using zirconia powder on alumina based substrates (col 4, lines 30-35). Hancock et al teach that zirconia melts at nearly 2650°C (col 1, lines 10-15).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to heat the zirconia with the laser so that it melts and that as the molten zirconia powder forms the surface of the refractory material, that zirconia part of the surface has been heated by the laser to at least 2650°C, which is above 2000°C (**claim 2**).

Response to Arguments

14. Applicant's arguments with respect to **claims 2-8 and 17-19, 21 and 22** have been considered but are not convincing in view of the new ground(s) of rejection necessitated by amendment.
15. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).
16. Regarding applicants argument that Bradley et al is directed towards furnaces and incinerators, while applicant's work is directed towards glass manufacturing processes: a Danner blowpipe in a glass manufacturing process is a furnace.
17. Regarding applicant's argument that Brennan et al teaches away from tempering of glass ceramics in order to strengthen them. MPEP 2141.02 states: "the prior art's

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mere disclosure of more than one alternative does not constitute a teaching away from any of these alternatives because such disclosure does not criticize, discredit, or otherwise discourage the solution claimed....” Brennan et al teaches that tempering is a known way to increase the strength of glass ceramics, so it is obvious to temper the glass-ceramic in order to increase their strength.

18. In response to applicant's argument that "some articulated reasoning with some rational underpinning" was not provided to motivate a tempering treatment of the refractory material, the examiner motivated the use of a tempering step in order to increase the mechanical strength of the refractory. It is readily apparent that it is desirable to increase the mechanical strength of refractory materials, since they are mechanically stressed. Furthermore, it is specifically useful to have refractory bricks of increased strength because they mechanically fail. For example, they crack, and cracking results when thermal stresses exceed the critical stress of the refractory, as seen in Triantafyllidis et al section 3.2, so a stronger refractory will crack less. As seen in Recasens et al, these refractory bricks have a tendency to fracture (col 3, lines 25-30), so the bulk strength of the refractory is important. Additionally, thermal stresses exist in the bulk of the material as well as their surface, if the strength of the surface is increased without increasing the strength of the underlying material, then the surface layer will be more likely to spall as the underlying material is broken before the surface.

19. Regarding applicant's argument that the addition of zirconia to the materials of Bradley would result in unpredictability, as seen in the newly applied Recasens et al,

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applicant's claimed composition (which is the Bradley composition with the addition of some zirconia) was also known to be used for refractory bricks, specifically bricks suitable for use in contact with molten glass for glass manufacture. Recasens et al further teaches that the addition of an appropriate amount of zirconia to the refractory has the effect of reducing cracking (col 3, lines 19-26). So there is an expectation of a good deal of predictability with these materials and no reason to believe the laser treatment would have some effect other than what is described.

20. Regarding applicant's argument that Bradley et al and Triantafyllidis et al both require preheating, while claim 22 does not: claim 22 does not exclude preheating, and Bradley et al does not require preheating, it merely teaches that not preheating produces somewhat more cracking than a treatment without preheating.

21. Regarding applicant's argument that Bradley et al and Triantafyllidis et al do not suggest methods to improve the surface of a refractory material so it can handle molten glass at very high temperatures of the glass melt, the examiner disagrees. Slag is molten glass, so they both are directed towards improving the refractory's handling of molten glass at high temperatures.

Conclusion

22. No current claims are allowed.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOEL G. HORNING whose telephone number is (571) 270-5357. The examiner can normally be reached on M-F 9-5pm with alternating Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael B. Cleveland can be reached on (571)272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/J. G. H./
Examiner, Art Unit 1712

/Michael Cleveland/
Supervisory Patent Examiner, Art Unit 1712